U.S. Department of the Interior

Interior Enterprise Architecture

Technical Reference Model
Guidance Version 3.0
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Editor's Note: To allow this document to retain manageable proportions, much information is provided in the form of companion documents, or as sections of the Department of the Interior's Web presence. Blue underlined text indicates a hyperlink to these documents or Web pages, and can be activated by holding the Control key down and clicking the left mouse button on the link. A separate window or program will display the reference, and so the reader's place will not be lost.

1 Purpose and Scope

1.1 Purpose

This document describes the nature, use, and benefits of the Technical Reference Model (TRM) within the Enterprise Architecture (EA) of the Department of the Interior (DOI). As a decentralized organization centered around eight Bureaus and supported by a national business center and several individual offices,   DOI maintains a full-time staff of about 70,000 located at over 2,000 sites across the United States and its territories. Information technology (IT) solutions have traditionally evolved in a localized manner within DOI, as within most Federal agencies. The requirements of the Homeland Security Act of 2002, the National Intelligence Reform Act of 2004, and the President's Management Agenda (PMA) dictate that these agencies adopt an EA consistent with that presented by the Office of Management and Budget (OMB) in a format called the Federal Enterprise Architecture (FEA).

A primary focus of EA is enabling an organization's continual and consistent alignment of the business strategies using such tools as architecture models. The TRM is the mechanism for modeling the technology resources employed to support these strategies. The DOI is incorporating the models in the FEA within the Interior Enterprise Architecture (IEA), and extending these OMB models in a disciplined manner in response to Bureau- and Department-managed functional requirements. Many DOI programs need to share information with outside partners, adopting those partners' technology selections.   In spite of numerous DOI-wide standardization initiatives, the bulk of the current IT environment remains heterogeneous and fragmented across its Bureaus. These self-contained systems were designed to meet the specific needs of individual Bureaus operating independent, self-sufficient programs, and their infrastructure reflects this diversity and insularity.

There is a growing demand for DOI to coordinate its business on a Department basis rather than a Bureau basis by increasing the integration of its functions, processes, and systems across all Bureaus. The rules in the BRM must be updated to form a new model of the business rules of DOI and enabled by the controlled use of standards, products[1], and acquired services[2] from the TRM. This new business model includes an increased need for:

1) citizen-centric one stop shopping;

2) coordinated service delivery across Bureaus;

3) more planned and coordinated partnerships with external organizations; and

4) streamlined administrative business processes.

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[1] Such as hardware, software, supplies;

[2] Such as telecommunication services, Internet connectivity services, security testing services.

DOI has a significant challenge to redesign and streamline its business approaches and processes to connect Bureaus to each other and their customers. It must also implement this as an IT environment that provides appropriate and secure access to information from any place at any time. In order to do this, DOI must make effective use of the TRM at all organizational levels to ensure that budget, security, interoperability, and functionality concerns are addressed according to all appropriate mandates and directions.

Questions regarding the Interior Enterprise Architecture should be directed to the DOI Chief Architect while questions regarding this document and the TRM in general should be directed to the DOI Chief Technology Officer (CTO).

1.2 Scope

This document addresses the purpose, structure, content, governance, and usage of the DOI TRM. The purpose of the TRM is to provide support, guidance, and regulation for the management and acquisition of technology within DOI. The strategic and tactical goals supporting this purpose are identified and described in Section 1.

The structure of the DOI TRM is derived from the OMB FEA. The relationship and conformance of the DOI TRM to the model provided by OMB is addressed in Section 0 to ensure that DOI does not diverge unnecessarily form the FEA.

The content of the DOI TRM is derived from several sources. To achieve uniformity of description and conformity across the Bureaus, procedures and restrictions must be observed in the entry and modification of the TRM content. Additionally, a methodical process for review and release of TRM versions is necessary to ensure that valid and useful information is available within the proper time frame. These processes are described in Section 1.

The governance of the DOI TRM defines who makes and approves decisions concerning its structure and content, and how those decisions are made and published. Standing bodies with cross-Bureau representation are identified by the roles they play and their interrelations in this process in Section 1. The use of *ad hoc* review teams to address specific TRM-related activities is also covered in this Section.

The usage of the TRM varies based upon the purpose of the user. In order to support these purposes, different presentations of the information in the TRM are needed; these are described in Section 0. Since the TRM must be a dynamic entity to support the rapidly changing technology use of DOI, this portion of the TRM Guidance document will change as the methods of information presentation are refined and expanded.

Several reference documents have significant impact upon the genesis and current state of the TRM. These documents are not included here, but are referenced through hyperlinks to provide the necessary context. Section 4.2.1 describes their handling for review in major releases of the TRM.

2   Strategic Initiatives and the TRM

With the introduction of the PMA, the process of government is directed towards measuring effectiveness based on products and services provided to the citizen. Measurement of effectiveness and value of performance is performed with the citizen as a customer, and agencies as providers with a mission to maximize effectiveness and value through cooperation and management of resources. The FEA provides guidelines and a methodology for accomplishing resource management among and throughout Federal agencies.

DOI's Office of the Chief Information Officer (OCIO) has established strategic initiatives to pursue the goals established by the PMA through application of the FEA across its constituent Bureaus and organizations. This effort improves customer service through integration and self-service facilities, avoiding compartmentalization of information and information-based services. Figure 1 shows a representation of the strategic path for achieving these high-level goals.
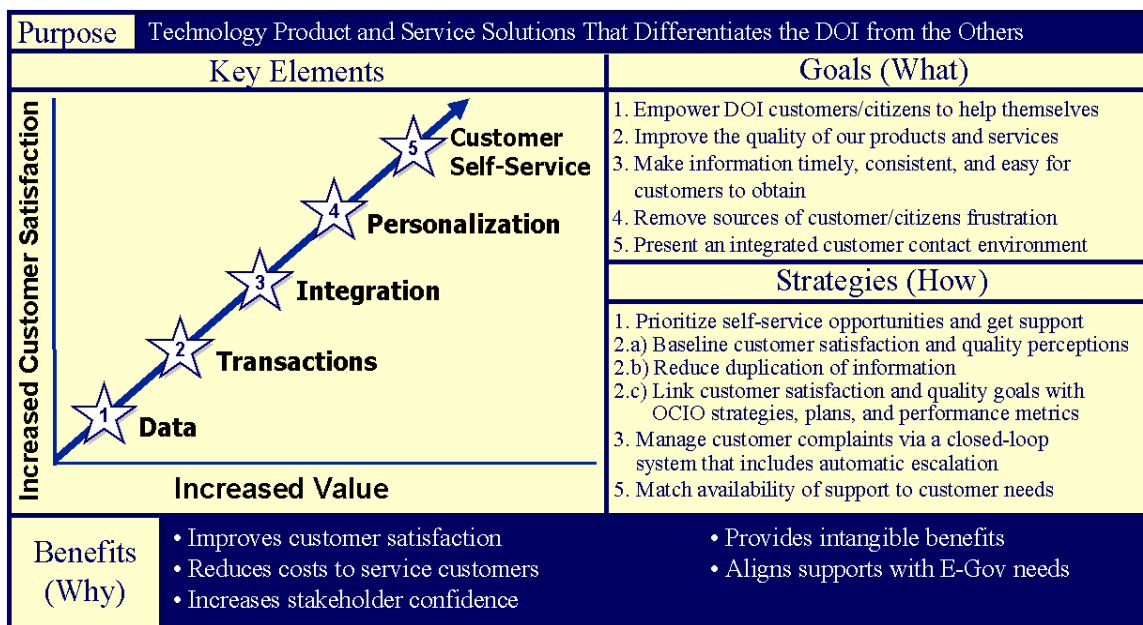
Figure 1. Primary Strategic IT Initiatives of DOI

Focusing on the mechanisms and methods of meeting these goals, further refinement is needed in order to identify and apply the revisions to current policy and operations needed to accomplish them. Figure 2 details the activities involved in IT planning and management, identifying ways in which more controlled and effective procedures can yield benefits in the cost and quality of customer service. The analysis and management activities must be addressed together in this process, because they depend upon common structures and facilities for their support and rely upon one another for their effectiveness. In relation to the FEA, each of these activities receives input from the reference models and provides the ability to maintain those models as an accurate representation of DOI.

The goal of performance enhancement is tied to how well the functions, assets, operations, and performance of DOI are understood and modeled in the IEA.
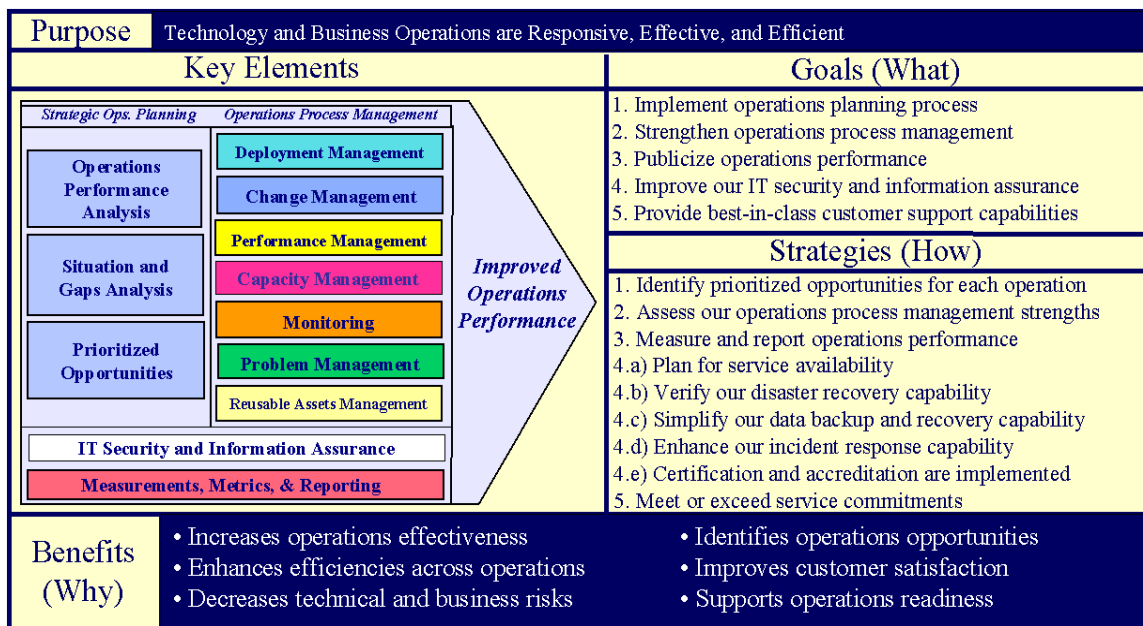
Figure 2. Application of Strategic Initiatives to IT Management

The TRM is the most rapidly changing model within the IEA. Its proper construction, population, use, and enforcement directly effect how well the strategic goals of DOI can be attained. The goals of resource sharing, common infrastructure use, and lowest Total Cost of Ownership (TCO) for technology products must be supported by the TRM and delivered to the offices and groups within DOI that administer its various IT and acquisition functions. Existing technology must be inventoried, classified, and prioritized for replacement or cost reduction initiatives; new systems must continue to be planned and implemented during this process without paralyzing Department customer service enhancement or violating IT strategic initiatives. In order to achieve these two goals, the TRM must adapt rapidly to incorporate new technology and must integrate with the Solution Architecture methodology for new system design and implementation. Figure 3 gives a representation of how the TRM fits into and supports the use of Solution Architecture to promote commonality and efficiency in ongoing DOI IT projects.

The use of Solution Architecture to allow advanced technology and systems to enter DOI is necessary to allow the To-Be technology may be addressed before the As-Is model of technology at DOI is completed. Limitations on funding and resources affect the speed with which the As-Is technology can be inventoried, and delays in the introduction of new technology and systems would be unacceptable if a strictly sequential process were followed. Solution Architecture allows the new systems to be planned, built, and integrated with existing systems by employing patterns of service and component modeling to ensure that commonality and interoperability are maximized. The technology standards, specifications and products that will support the DOI mission set can thus be made available through the TRM to support Solution Architecture and allow

DOI to make maximum progress toward both increased customer satisfaction and reduced system implementation and operation costs.
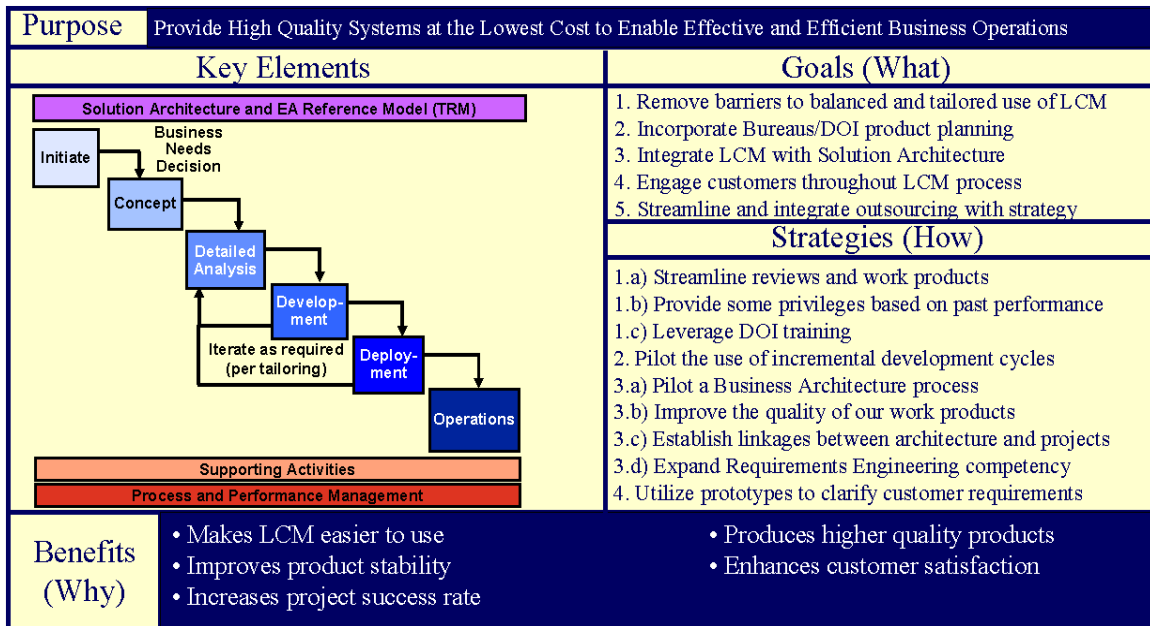
Purpose	Provide High Quality Systems at the Lowest Cost to Enable Effective and Efficient Business Operations	
Key Elements		**Goals (What)**

Figure 3. Strategic use of the TRM in DOI IT Initiatives

The four uses of the TRM in DOI's IT strategy reflect different communities of interest, but all share the same goal of improving the effectiveness and decreasing the cost of IT procurement, management, and operation throughout the technology life cycle. Section 4 describes the different phases of technology use that affect the TRM to allow entry and update on the necessary information in the TRM; Section 6 describes the initial presentation of this information to support these multiple application of the TRM to DOI IT strategic goals.

The alignment of the TRM with Solution Architecture not only requires that additional information be placed in the TRM, it requires different characteristics to be identified for technology items that will be used to populate architectures in the future. In particular, a Business Use or Size Constraint field is needed so that restrictions on the application of technology items within a particular design pattern or system can be appropriately regulated. For example, some OpenSource applications are needed for scientific research and communication with research partner organizations, but are not able to scale up to enterprise service levels or security standards; these items can be identified as Preferred where their characteristics allow them to provide low cost without violating departmental security or mission constraints.

Similarly, the use of design patterns allows construction of a solution that can be implemented through a variety of platform and interconnection options. The two platform options of most interest at present are J2EE and .NET platforms. Figure 4**Error! Reference source not found.** and Figure 5 show the IMARS target solution as implemented through J2EE and .NET platforms. Many standards and several products in the TRM are applicable to both environments; far more products have capability in one or

the other platform which recommends their use in that platform only. Development of platform information and use context information, and its harnessing to Solution Architecture tools, is a key step toward increased interoperability and resource sharing throughout DOI.

Several overall guidelines emerge from application of the Solution Architecture to DOI's enterprise strategy. First, due to unresolved security issues with firewall protection, .NET solutions may be restricted to internal use, with the preferred enterprise platform being J2EE and either Linux or UNIX to provide secure external interfaces[3]. Second, the consideration of business criteria or size considerations is vital to the proper use of technology. Many scientific applications use OpenSource software to process, store, or communicate data in order to be compatible with other Government agencies and educational institutions; while OpenSource software is generally not viewed as being secure and robust enough for enterprise-level usage, its application to this specific business and size context is appropriate, and results in cost savings to DOI. Other commercial software, such as the SAP Portal product, is suitable for use in financial applications as embodied by the Financial and Business Management System (FBMS), but has limitations for general portal applications; therefore, its use with FBMS is appropriate, but other use is restricted. This also implies that a classification is needed for software that may continue in use indefinitely, but is subject to stringent oversight to justify its continued use through connection to mission requirements.

While the TRM has not yet been integrated with Web collaboration tools and Solution Architecture tools, this is a key step in maximizing its usefulness to DOI and the Bureaus. Version 3.1 will focus on the evolution of the Solution Architecture use of the TRM. Identification of suitable technology products from the TRM will be used to assist in providing Acquisition with information on requirements and characteristics to streamline the procurement process. Figure 6 shows an example of mapping candidate products to the standards areas they inhabit in the Solution Architecture frameworks.

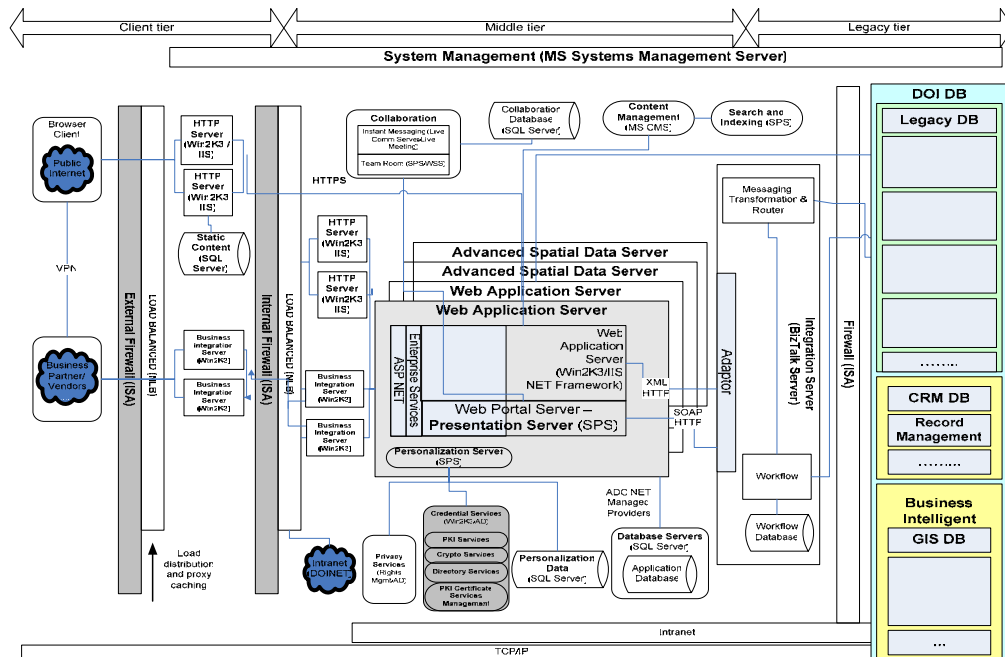[3] This position is under review and has not yet been submitted for CIO approval.

Figure 4. .NET Platform Solution for Small to Medium Solutions
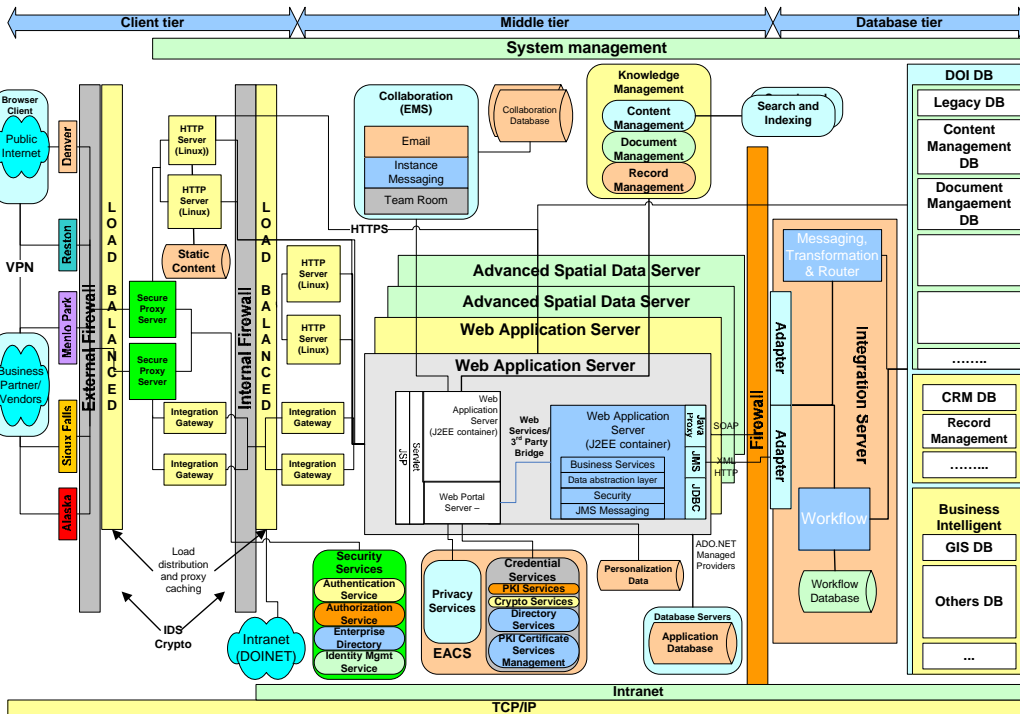
Figure 5. J2EE Platform Solution for Small to Enterprise Solutions

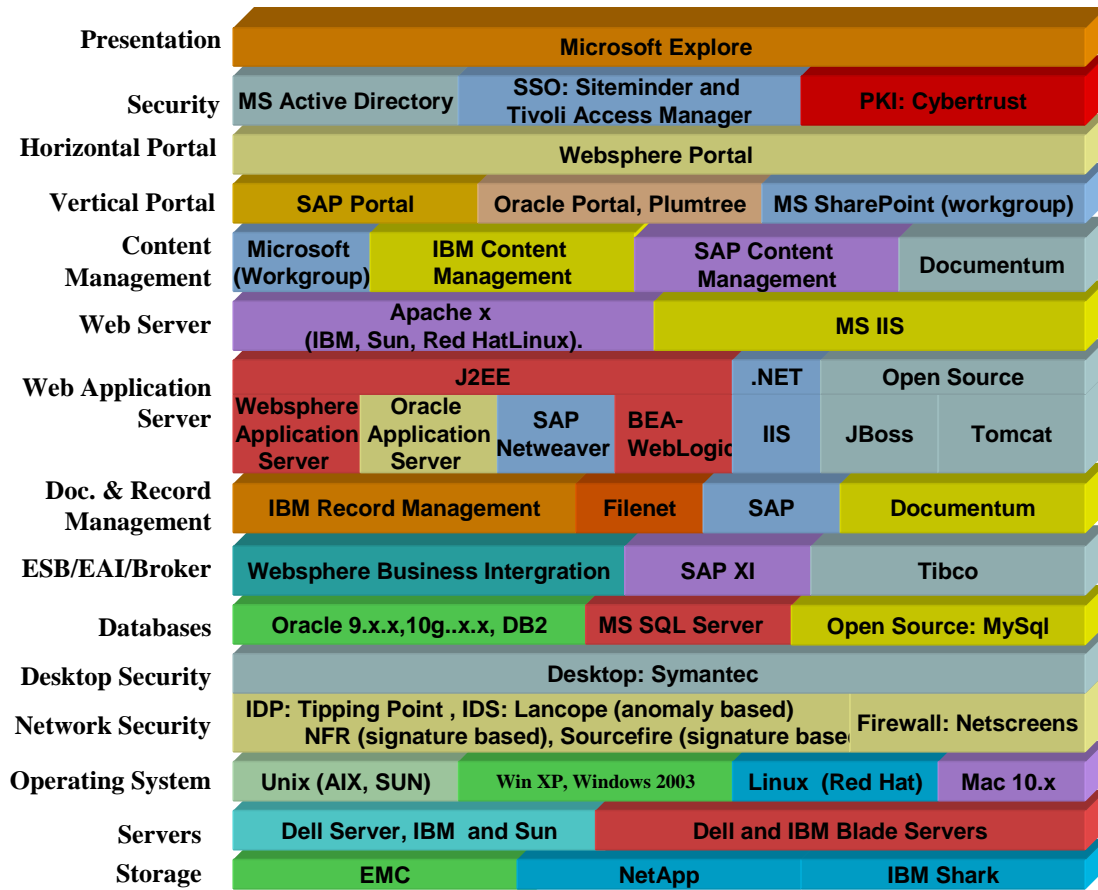| Presentation	Microsoft Explore			
Security	MS Active Directory	SSO: Siteminder and Tivoli Access Manager	PKI: Cybertrust	
Horizontal Portal	Websphere Portal			
Vertical Portal	SAP Portal	Oracle Portal, Plumtree	MS SharePoint (workgroup)	
Content Management	Microsoft (Workgroup)	IBM Content Management	SAP Content Management	Documentum
Web Server	Apache x (IBM, Sun, Red HatLinux).		MS IIS	
Web Application Server	J2EE		.NET	Open Source
	Websphere Application Server / Oracle Application Server / SAP Netweaver / BEA-WebLogic		IIS	JBoss / Tomcat
Doc. & Record Management	IBM Record Management	Filenet	SAP	Documentum
ESB/EAI/Broker	Websphere Business Intergration	SAP XI	Tibco	
Databases	Oracle 9.x.x,10g..x.x, DB2	MS SQL Server	Open Source: MySql	
Desktop Security	Desktop: Symantec			
Network Security	IDP: Tipping Point , IDS: Lancope (anomaly based) NFR (signature based), Sourcefire (signature based)		Firewall: Netscreens	
Operating System	Unix (AIX, SUN)	Win XP, Windows 2003	Linux (Red Hat)	Mac 10.x
Servers	Dell Server, IBM and Sun	Dell and IBM Blade Servers		
Storage	EMC	NetApp	IBM Shark	

Figure 6. Product Mapping to Enterprise Solution Standards

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3   The Interior Enterprise Architecture TRM

The focus of the IEA is on providing guidance for IT issues and initiatives that are DOI-wide or multi-Bureau in scope. All Technology evaluation, classification, and selection activities will follow the Technology Architecture Principles presented in the Interior Conceptual Architecture document.

The TRM Compliance Classification Evaluation Criteria Categories, as DOI-specific Performance Measurement Categories, are:

1.   **Enterprise Architecture Conformance** – how well the product supports the architecture. This is measured by how well it complies with each *relevant* architectural principle.

2.   **Leverages Existing Enterprise Licenses** – Products and Acquired Services under Enterprise License have already gone through extensive evaluation and can have their Enterprise License expanded across the Department.

3.   **Complies with Federal and/or Open Standards** – Products and Acquired Services that are fully compliant with existing relevant Federal and/or Open Standards are accepted as meeting the evaluation criteria of this evaluation process.

4.   **Vendor Viability**- measures the ability of vendors to support their offering, survive in the marketplace, and keep up with changing technologies. Vendor past performance elements are reported by the contracting office, input into a Government-wide eGov database where all agencies report on vendor contract performance, and are then used as part of the overall evaluation criteria for new procurements.

5.   **Management Attributes** - more general and management-oriented criteria, such as performance, availability, etc., which measure the overall ability of the product to deliver the functionality.

6.   **Total Cost of Ownership** - evaluates the cost of ownership that is not directly paid to the vendors as acquisition and maintenance costs[4]. This might include product change-over or support costs or reduced support costs due to modular design. The acquisition and maintenance costs paid to vendors are considered separately under price evaluation and are not part of this technical evaluation process.

7.   **Function** - the specific product functionality being sought based on documented business requirements and performance criteria, and the technology being analyzed (e.g., specific standard compliance, such as EJB, Java SDK; functions specific to the type of hardware or software being analyzed, such as languages supported by a development tool; fulfilling capability, fulfilling capacity, etc.).

Each of these measurement categories consists of multiple evaluation criteria that are used to determine an overall score for the area[5]. The Function evaluation criteria tend to

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[4] Per FAR 46.7 warranties are part of the evaluation process performed by the contracting officer and must be considered as part of the total acquisition costs if they are needed.

[5] This is a technical rating, not to be confused with the Acquisition evaluation process.

change the most for each decision as the functional requirements change based on both the type of decision being made (e.g., database, system software, system hardware) and the business requirement the decision is to satisfy (e.g., personal workstation, workgroup server, or database server). It has also become apparent that the business context and scope of deployment for technology items can have significant impact on their suitability; therefore, qualification of the environment for which a product is evaluated becomes a necessary factor in the scoring process. The criteria for the Management Attributes category may also vary somewhat for each decision while the Enterprise Architecture Conformance, Vendor, and Cost of Ownership criteria tend to vary the least. An assessment of these seven key criteria will be combined with cost information to determine the Best Value for specific areas of application and the most attractive solutions for delivering value to the Government, and may serve as input to Acquisition for their vendor evaluation.

4   TRM Life Cycle Activities

Like most processes involved with IT and service provision, the TRM has a life cycle that governs the planning and management activities. Technology standards, specifications, and products ("technology items") must be viewed in terms of their useful life span through all areas of policy, procurement, operations, and change management. Figure 7 provides a view of the use of the TRM depending upon which stage of the life span is being addressed, and the effects of technology management on the TRM. Based upon the information in the DEAR repository, systems in operation have been identified and their technology components inventoried. This portion of the TRM is being subjected to the Validate phase, where information in the TRM is compared to current Bureau operations and corrections in the linkages or descriptions of the technology can be made. Acquisition involvement to discover and prioritize candidate technology for Enterprise License Agreements (ELAs) and for retirement is essential.
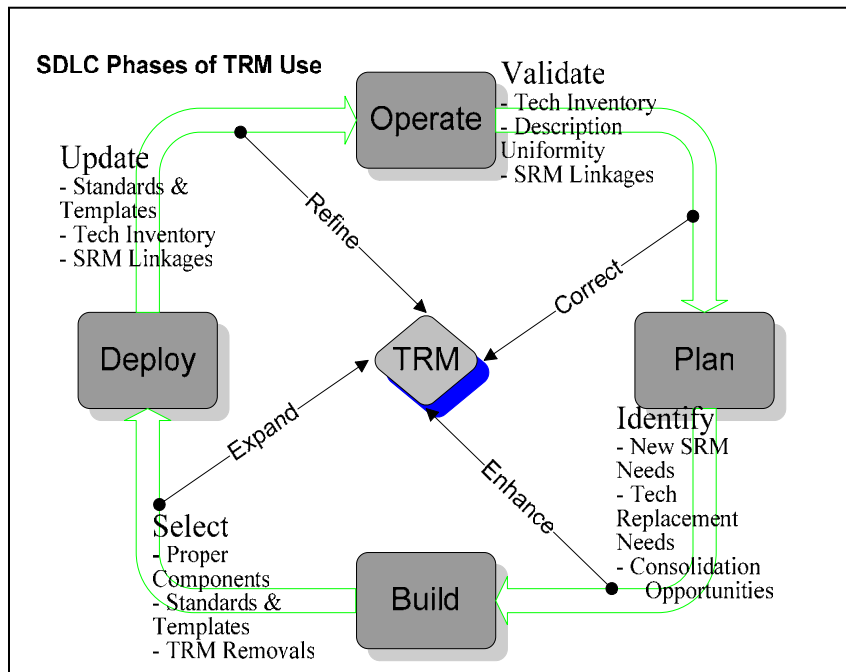

Figure 7. SDLC Phases of TRM Use

While this is in progress, the need to design and implement new systems must also be satisfied. Technology not already in the TRM but needed to plan, build, and deploy these new systems must be identified in the form of standards and specifications that can be used for these new systems, and then in the form of products which conform to those standards and specifications. Thus, the Identify and Select phases for this different technology must proceed simultaneously for DOI's mission parameters to be served. Acquisition involvement is again needed, here to qualify those technology products that meet DOI's functional and cost needs, and to ensure that proper competitive practices are observed.

4.1 TRM Update

One of the primary purposes of updating the TRM is to keep up with changes in the technology marketplace. New standards develop, and spawn specifications to identify operational choices within their prescribed boundaries. Products then enter the marketplace that implement these standards with varying degrees of conformity and capability. All of these must enter the TRM in a timely fashion to allow DOI to benefit from new technology and not fall victim to inadequate or aging technology.

4.1.1 Technology Item Classifications

Entries in the TRM reflect technology at all stages of life. In order to distinguish the new from the old, and to identify the capable and the unacceptable, a classification methodology has been developed and applied to the items in the TRM. DOI has developed a classification system that indicates where in the spectrum of useful and unusable these technology items lie, and what restrictions govern their application. Discussion is still underway concerning a finalized list of classifications, but Figure 8 shows the current set of classifications used and their significance for technology acquisition and use.

Figure 8. Classifications Used in the DOI TRM

Life Cycle Classifications	Definition/ Meaning	Technology Time Frame Constraint
Licensed by DOI	DOI-wide enterprise agreements are in place for these hardware and software products or service standards	This technology must be used within its intended functional/technical domain where it satisfies mission requirements.
Preferred	These Products/Standards are known to meet DOI's needs; there may be others.	This technology may be used immediately without further CIO clearance. All new technical solutions will use the Licensed by DOI or Preferred classification of technology, unless given an IEA Waiver. For the IEA Waiver process, see Section 5.2.
Limited Use	Develop solutions using these Standards or Products only if there are no suitable alternatives categorized as Preferred; if a Preferred product is available that will meet the requirements, plans should be developed to move from Limited Use to Preferred. Requires IEA Waiver for new or expanded use.	This technology may be used for existing technical solutions but may not expand its role. Plans to replace this technology with Preferred technology through the technology refresh cycle must be made and implemented as budget and priorities allow. A quarterly report from Bureau CIOs to the Department CIO must detail Limited Use technology and the progress in implementing the plans to

Life Cycle Classifications	Definition/ Meaning	Technology Time Frame Constraint
		replace it.
Obsolete	Being phased out; (e.g., vendor support ending); plans should be developed to rapidly phase out and replace (often to avoid substantial risks). Requires IEA Exception. Requires IEA Waiver for new or expanded use.	This technology must be replaced within six months. Plans to replace this technology with Preferred technology must be completed within six months, with funds gained through reprogramming by the owning Bureau. A three month extension on the execution of these plans may be requested.
Evaluation	Product/Standard to be used in conjunction with limited duration technology evaluation efforts only (e.g., testing, pilots). No IEA Waiver is required, however, before use an email notification of use must be provided to the DOI Technical Architect.	This technology may be used in brief-duration (i.e., less than 1 year) prototype and pilot technical solutions, operating only within a Test-Bed network environment. Prototype and Pilot results will be used by evaluators to determine whether to promote this technology to Preferred classification or to Reject it. Quarterly status reports must be submitted via email to the DOI Technical Architect. Final results of the prototype or pilot performance must be submitted via email to the DOI Technical Architect, and this Final Report must be acknowledged via email prior to the prototype or pilot discontinuance.
Rejected	Product/Standard has been evaluated and found not to meet technical architecture needs or to have serious security flaws. IEA Waiver typically not allowed.	This technology may not be used under any circumstance and must be immediately replaced by the owning Bureau.
Pending	Product/Standard has been submitted for evaluation. This technology cannot be used while Pending, so an IEA Waiver is not applicable.	Submitted Pending technology may be retained in this status indefinitely. It may not be used until provided either Preferred, Limited Use, or Evaluation classification.

Figure 8. Classifications Used in the DOI TRM (continued)

4.1.2 TRM Update Methodology

The technology items identified as part of TRM version 2 have been extracted and placed in a tailored presentation for three reasons:

1. Identification of discrepancies and conflicts in the DEAR data is made easier and faster, and suggested fixes can be applied for examination and approval without involving the main DEAR repository;
2. Reporting and extraction for review and revision by TET teams can be done efficiently, and the application of revisions can be automated to minimize the effort and delay involved; and
3. Acquisition planning and implementation requires external information that is not (and should not be) tracked in DEAR.

With the impetus for adding more information on technology items to support new projects, the Tmart plays a larger role in allowing approved information to be made

available to the technology community rapidly and flexibly, while allowing automation of the cycle to update and re-extract information from DEAR[6].

To make efficient use of the efforts of TET team members, the following process will be followed to update the Tmart contents and allow publication of TRM V3:

- Information in the Tmart will be cleaned and have any elements not transferred from TRM V2 merged into the data;
- A concise list of technology items will be generated based upon the mapping of TET focus areas to TRM "Technology Standard" field contents. In a few cases, more than one TET will receive technology items for review because they both have aspects of their focus that involve a particular Technology Standard. As a concrete example, the Security and Service Continuity TET will have its focus involve several other TETs.
- This list will be circulated to each TET in the form of a spreadsheet, with an inventory of the technology items of concern to that TET. Within the spreadsheet, additional columns will be provided to allow the TET to nominate changes in:
  - o Taxonomy – whether the technology item is correctly identified within the Area, Category, and Standard hierarchy of the TRM; and
  - o Classification – whether the assignment of Licensed by DOI, Preferred, etc., needs to be revised for the next TRM release.
- Returned spreadsheets from the TETs will be compared and a list will be produced of all technology items for which changes have been nominated[7]. Where all TETs concerned are in agreement, change nominations will be included in a Change Nomination Agreement Report for discussion at the TET review meetings. Where there is disagreement among TETs concerning the nomination of taxonomy or status changes, a separate report will be generated to focus attention on resolution of the difference. DOI will address the difference and attempt to reach consensus on the change nomination prior to TET meetings. If consensus is not achieved, the differing views will be discussed at the TET meetings and will be reconciled by the final TET meeting.
- Update of the Tmart from the consolidated return of spreadsheets will be performed automatically, and a final report of changes will be produced for verification to the TETs that changes are accurately reflected in the data. This information will be presented with a full set of technology items to the CTOC for approval.

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[6] This process is necessary to ensure that the DEAR database and the Tmart have their contents reconciled on a periodic basis. Initial extraction into the Tmart was a complex process; it will be streamlined and automated following the release of V3.0.

[7] A tool has been created using Microsoft Access that uses office automation capability to extract changed and added items from a group of Excel workbooks and organize the information into a database. The tool will then provide reports for use in reviewing the information, and allow selection of changes to be transferred to the Tmart. A office automation capability is also provided to transfer selected updates to the Tmart. This enhances the repeatability of the TRM data collection process.

- TRM V3 will then be made available through the Department's Architecture Web site, with the Tmart available for query. A static version of the Tmart contents will be generated to produce a PDF-format document representing the release of TRM V3, but the Tmart contents will change as new technology items are addressed by the TETs and approved by the CTOC.
- DEAR update from the TRM Tmart contents will be established as an automated and repeatable procedure, working together with the DEAR IPT. The ability to re-extract DEAR information to re-populate the Tmart will also be provided, to ensure that DEAR and Tmart contents can be brought to total agreement periodically.

4.1.3 Technology Template

Information on technology items will be presented for review in Excel workbook form, so that returned information from reviewers can be compared and collated with a minimum of effort. The full workbook can be viewed by clicking the hyperlink above; abbreviated versions of the large sheets found therein are shown here for discussion of their important characteristics[8]. Here is a preliminary description of the intended use of the template and the returned reviewer information.

Figure 9 shows a sample of the first sheet of the workbook, containing the technology items to be reviewed by a specific TET or Sub-Team. Prior to generation of the review spreadsheets, data will be re-extracted from DEAR to ensure that current and complete information is used for the review. The column for New Classification is constrained to the approved Classifications (slightly abbreviated) of Licensed by DOI, Preferred, Limited Use, Obsolete, Pending, and Evaluation. Where a particular technology item should have a new Classification, you should select the appropriate Classification in this column. In addition, a rationale for the reclassification should be provided in the rightmost column; in particular, if the reclassification is based upon requirements not met by the particular technology item, the requirements and deficiency should be noted here to assist in resolving reclassification differences among Bureaus.

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[8] With the assistance of the OCIO Enterprise Resource Management team, many fields were added to the spreadsheets in the TRM Update Workbook to capture information on contracts and procurement. By "piggybacking" the collection of this data on the technology data review, ERM can get the data needed to analyze the as-is technology items of DOI to perform effective portfolio management and to identify high-return targets for new Enterprise License Agreements (ELAs) and Blanket Purchase Agreements (BPAs).

Figure 9. Technology Specification Review Spreadsheet Example

Technology Area	Specification Type	Classification	Technology Specification	New Classification	Rationale
Application Servers		Pending	Servlet Exec		
	Product	Limited Use	Bea Weblogic		
			Domino		
			Novell NetWare OS (version 5.1)		
			Prolifics JAM		
			Prolifics Tuxedo-Lite		
			SigmaPlot		
			Sybase EA Server		
			Tuxedo-Lite (Prolifics)		
		Obsolete	Microsoft Windows OS (version < 2000 SP3)		
		Pending	CITRIX		
			Extensis Portfolio Server		
			JRun		
			Microsoft Exchange Server		
			Plumtree Content Server		
			Probaris		
			WebObjects		
		Preferred	(many vendors') Linux OS (All)		
			(many vendors') Unix OS (All)		
			Brio Ondemand Server		
			CITRIX (Version > 2)		
			Cold Fusion Server		
			ESRI Tools [Application Servers]		
			IBM Websphere (Version > 3.5)		
			JBOSS (Version > 1.4)		
			Macromedia Cold Fusion Server (Version > 4.51)		
			Microsoft Windows OS (2000 Server, Adv. Server > SP2)		
			Oracle (Version > 8.1)		
			Oracle [Application Servers]		
			TOMCAT		
			TOMCAT (Version > 1.1)		
			Websphere		
Application Servers	Product	Evaluation	Microsoft Windows OS (version Server 2003)		
Certificates / Digital Signature	Standard	Preferred	Digital Certificate Authentication		
			FIPS 186-2		
			Secure Sockets Layer (SSL)		
			X509		

The second sheet of the workbook contains most of the column headers from the first page, but is intended for noting taxonomy issues. If a particular technology item is present in the first sheet, but does not appear under the appropriate Technology Standard, the alternative information should be provided here, with a rationale of "Taxonomy" to identify the information's structural impact.

Figure 10. Taxonomy Issue Spreadsheet Layout

Technology Area	Specification Type	Classification	Technology Specification	Rationale	System Acronym	Sponsor(s)

A third sheet is included for proposing the addition of new technology items to the TRM[9]. Since representation of large spreadsheets is cumbersome in document form, the following page contains the field listing of those information items that should be submitted with each new technology proposal. The addition of new technology requires more planning and information-sharing than reclassification of listed technology, and so this page should be viewed as a preliminary submission for later action.

Workbooks may be returned to the DOI CTO once they have been completed, or the TET may perform a preliminary conflict resolution function internally. It will probably be easier to have several reviewers fill out different sections of the workbook; for this reason, reviewers should first rename their workbook to include their organization and initials, such as ReviewBook-BLM-RJK.xls. As noted in the Methodology section, reports will be generated from the combined review workbooks to identify
- Unchanged technology items
- Reclassified technology items where all reviewers agree
- Reclassified technology items where disagreement requires resolution.

Meetings will be held to discuss the reports and provide resolution prior to submission to the CTOC for approval to update the TRM.

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[9] The addition of new technology requires more planning and information-sharing than reclassification of listed technology, and so this page should be viewed as a preliminary submission for later action.

Figure 11. Fields for Proposing New Technology Introduction

Technology Specification Attribute	Technology Specification Value (Sample Data)
1. Submission Author's Email	gomer_pyle@usmc.mil
2. Technology Service Specification Name	Novell Directory Services
3. Technology Specification Type (Specification, Standard, or Product)	Product
4. Specification Authoritative Location (e.g., For Single Product or Standard)	http://www.novell.com
5. If Specification is Product, Identify Supported Standards. For Supported Federal Standards, cite the FIPS compliance number(s).	LDAP V3
6. Product, Acquired Service, or Standard Supplier	Novell, Inc.
7. Product or Service Brand	eDirectory
8. Product or Standard Version	27
9. Product Release	27.3
10. Product or Standard Acquisition Source	Contract 1234xyz
11. Product or Standard Maintenance Contract End	Sep 30, 2006
12. Specification Community of Interest URL (one or more)	http://www.opendirectory.org
13. Recommend Service Domain(s), Type(s) or Component (s) to Apply Specification	All
14. Recommended Business Area(s), Line(s) of Business (LOB), or Subfunction(s) to Apply Specification	All
15. What other detailed specifications (e.g., products, acquired services, or standards) in the current DOI Technical Profile appear to perform the same or similar functions?	MS Active Directory, Sun/Netscape Directory, Identity Management Directories, other Access Control directories in product suites, other Personnel Directories, other Resource Catalogs.
16. Features/capabilities that distinguish this specification from other current DOI specifications performing the same or similar functions and thus justify the TET efforts to include and apply it.	Free, longtime stability, globally ubiquitous deployment, flexibility, supports Metadirectory use.

4.2 TRM Release and Publication

The TRM is a living resource, which must keep pace with the rapidly changing nature of today's technology. However, it is also important that version and change control be applied to the TRM just as it must be applied to the technology that it references. In order to accomplish this control and to identify with certainty which set of classifications and specifications are involved, numeric designation for the TRM releases has been adopted.

To distinguish between full releases, published in their entirety for cross-comparison with FEA guidelines and structures, and partial releases that reflect limited changes in the specification or classification content of the TRM, a major and minor release structure has been adopted. Major releases will be issued as a set of documents that freeze the status of the TRM to allow widespread review, comment, and reference; such versions will have a number such as 2.0 or 3.0 to indicate their major significance. Minor releases will be designated with numbers such as 3.1 or 3.2, to indicate their sequence and to allow identification of specific changes to the TRM with the numeric designation. Minor releases will frequently be modifications to the content of the TRM, and will be published only as updated content for the online Tmart or its derivative reports available to the DOI technology and acquisition community.

4.2.1 Major Releases

The extraction of data from DEAR and its incorporation into the Tmart serve to keep the TRM aligned with the Bureau inventories represented by the BEAR repositories. Scheduling and timing of the BEAR rollup into the DEAR repository occurs independently from the review of technology in the TRM, and so coordination is needed to ensure that the extraction and re-insertion of Tmart content into DEAR do not conflict with scheduled freezes. The fact that data in the BEARs originates from differing environments means that some data cleaning will be needed in each iteration, to unify specification names and manufacturer designations, thereby avoiding duplication.

The following steps will be followed for Major Releases of the TRM:

1. Extract data from the DEAR repository to capture Bureau inventories
2. Consolidate and correct any non-conforming data entries in DEAR data
3. Merge DEAR data with Tmart contents
4. Establish Technology Evaluation teams (TET)s for specific review areas
5. Distribute specifications to TETs established by the CTOC for review of classification and addition of new technology
6. Analyze review results and identify
    a. Unchanged classifications
    b. New or Changed classifications where all reviewers agree
    c. New or Changed classifications where disagreement exists
7. Obtain agreement through CTOC on resolution of classification disagreements

8. Thank and release TET members
9. Provide TRM update draft report for approval by ITMC
10. Clean submitted data and produce Configuration Management reports for Unchanged, Deleted, and Inserted products[10].
11. Publish report and document updates for the new Major release of the TRM
12. Revise DEAR repository to reflect new technology and classifications.

Figure 12 shows a graphical representation of the procedure for a major release of the TRM.
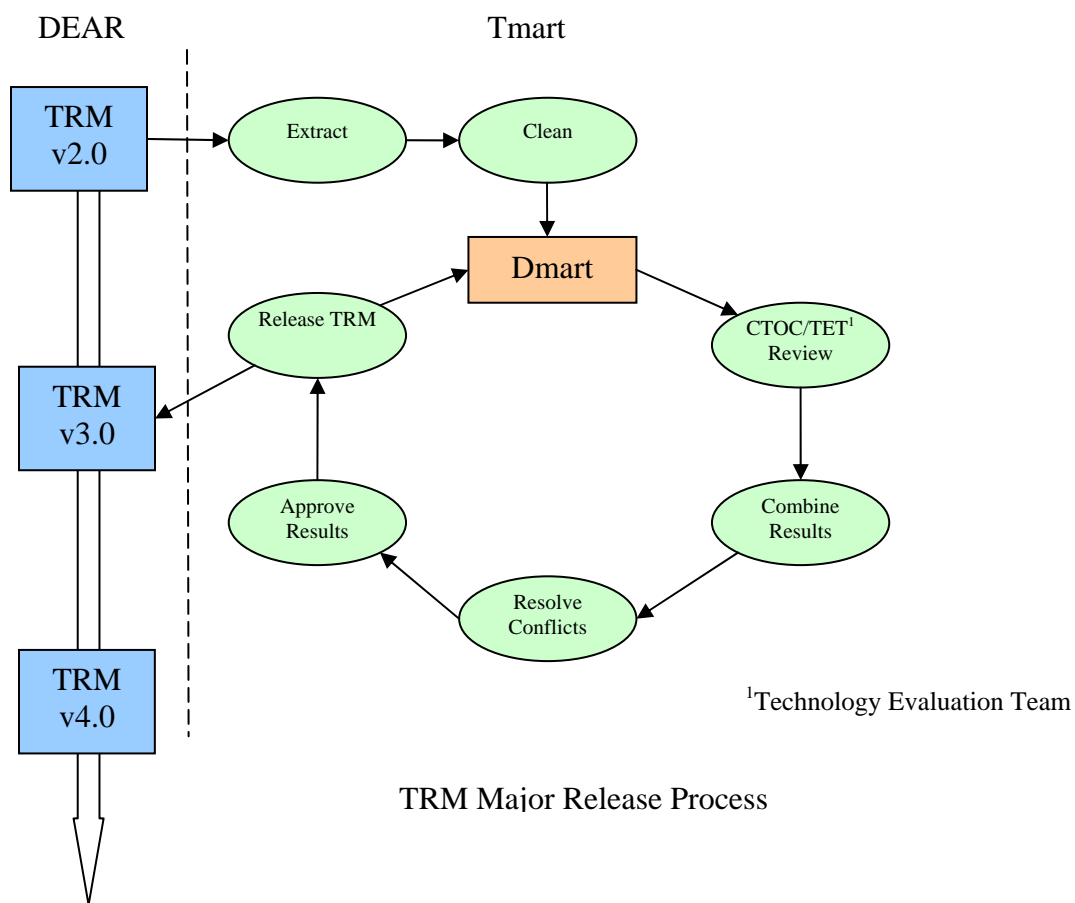
Figure 12. TRM Major Release Procedure

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[10] Please note that Unchanged refers to the classification of the product for DOI use. Products may have version numbers updated, names changed, or their position in the TRM taxonomy revised in order to clean the data or reflect technology shifts; these are not considered changes for CM purposes.

4.2.2 Minor Releases

Technology items in the TRM are available to the DOI technology community, but need to reflect DOI priorities and acquisition guidance that cannot be provided all at once, due to the initial magnitude of the items to be considered. The refinement of information on the enterprise licensing status or acquisition approval status of specific products and services within the TRM for use throughout the Department requires updates to the TRM based upon the priority of the standards or products concerned. Re-extraction of information from DEAR is not needed, since a very small minority of TRM content will be affected.

The following steps will be followed for Minor Releases of the TRM:

1. CTOC produces recommendations for technology requiring technical and/or acquisition analysis
2. ITMC prioritizes targets by criticality and potential cost savings size, then schedules reviews
3. CTOC forms TETs for technical evaluation of DOI requirements met by technology items
4. CTOC recommends suitable technology items to Acquisition[11]
5. Request manufacturer information on technical capability and timing of releases or feature availability
6. Review manufacturer responses and select matching technology that meets DOI technical requirements
7. Thank and release TET members
8. Update Tmart to indicate revised classification and usage information
9. Publish Minor release of TRM on Intranet for DOI use
10. Produce "delta report" of any items intended for but not included in this release.

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[11] The CTOC may provide the requirements (items) to Acquisition but it is the acquisition office's responsibility to determine the appropriate procurement method using competition.

Figure 13 shows a graphical representation of this process.

TRM Minor Release Process
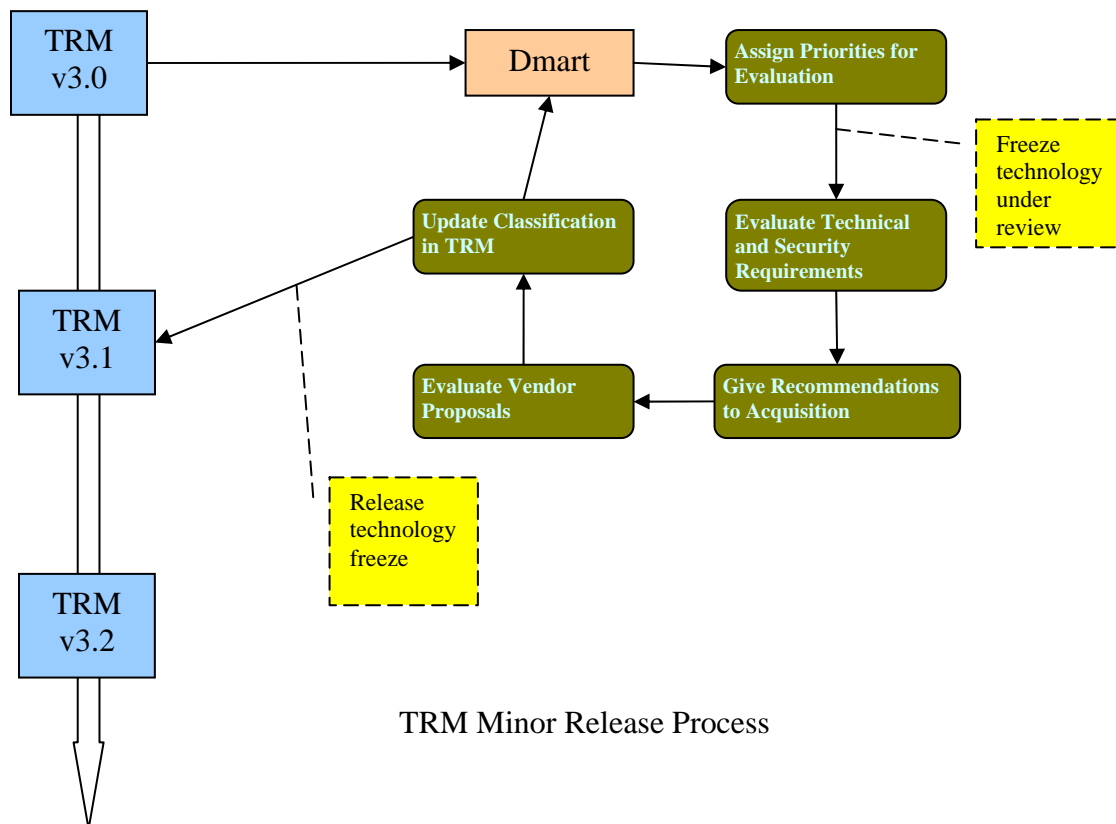
Figure 13. TRM Minor Release Procedure

4.2.3 Non-Release Activities

The generation of Minor releases of the TRM will be triggered by technology or acquisition issues requiring reclassification or addition of technology items. The generation of Major releases of the TRM will be triggered by time considerations or by external events requiring large-scale introduction of new technology items or issuance of the TRM as a reviewable document. Along with these action-based milestones, a yearly review of technology and acquisition priorities will be conducted. DOI needs this review to maintain alignment of the technology priorities of the Department with its mission and architectural goals. Figure 14 shows how major and minor releases align, and the accompanying yearly review process, which is independent with respect to timing.
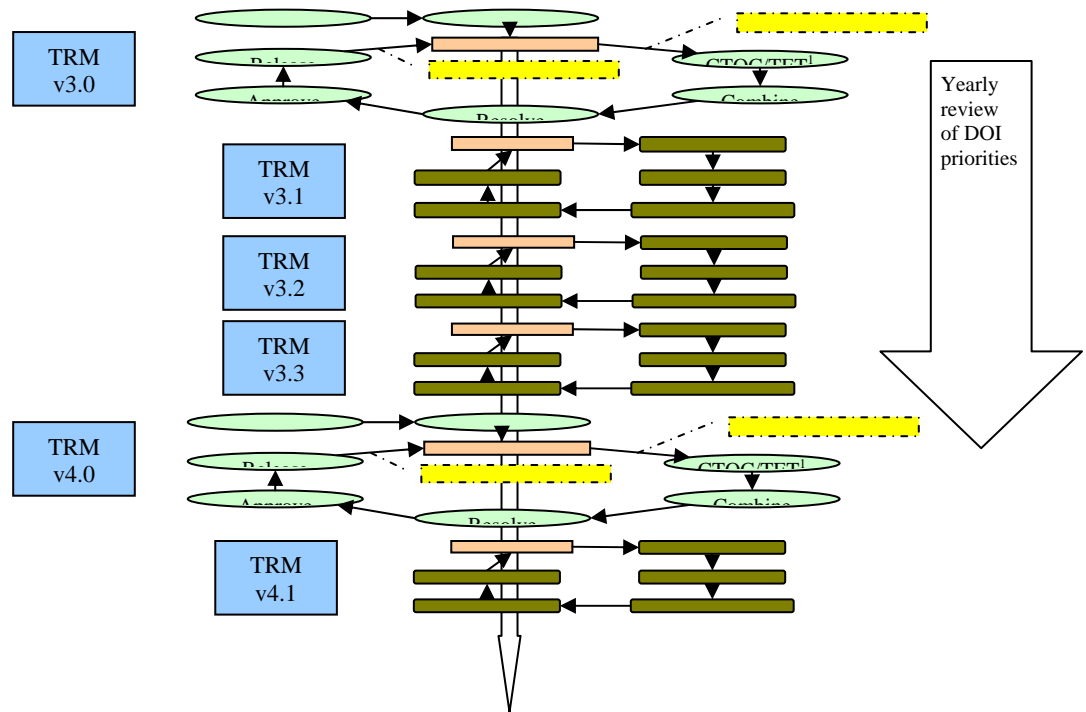
Figure 14. TRM Releases and Priority Alignment

5 TRM Governance

In order to be of value, the TRM must be subject to a governance structure. This will provide:

- Protection of the TRM structure from changes that add incorrect linkages or remove functional relationships;

- Protection of the TRM data from incorrect or duplicative entries;

- Enforcement of procurement restrictions mandated by product classification;

- Permission to procure products or services not available through the TRM on a waiver basis; and

- Conformance of the DOI TRM with the FEA models and relationships prescribed by OMB.

The IEA Governance Bodies are responsible for all aspects of governance[12]. Figure 15 shows those bodies and their relationships, in terms of responsibility and approvals. For example, the Investment Review Board (IRB) has the responsibility to charter the e-Gov Team and the Interior Technology Management Council (ITMC), define the decision authority those boards have, and review recommendations in decision areas addressed by those boards that do not fall within their decision authority.
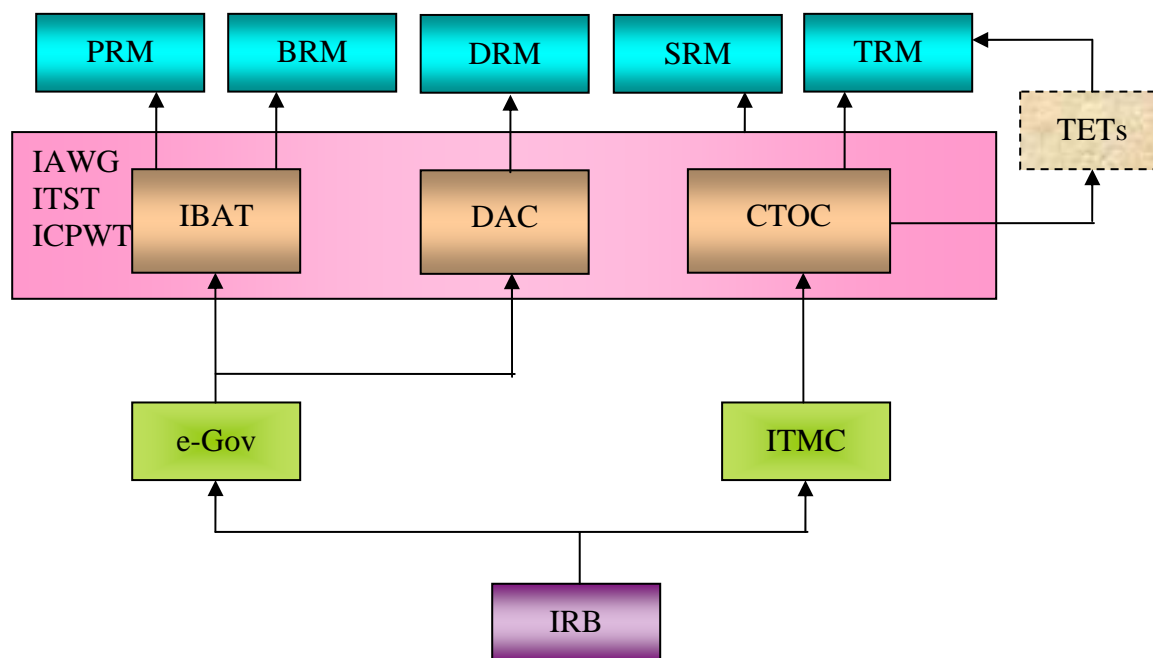
Figure 15. IEA Governance Bodies and Relationships

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[12] Descriptions of IT Governance herein refer to documents still under revision. The hyperlinks to those documents are presented here, and they should be considered the authoritative source for IT Governance information.

5.1 Structure and Linkages

The Interior Architecture Working Group (IAWG) will be responsible for reviewing structural aspects of the TRM and its linkages to the SRM for conformity with the OMB FEA TRM. Any changes in TRM structure will be implemented by the IAWG. Communication and coordination among the Interior Business Architecture Team (IBAT), the Data Architecture Council (DAC, formerly the IDAT), and the Chief Technology Officers' Council (CTOC) will also be supervised by the IAWG to ensure that content uniformity and relational integrity are maintained within the IEA model set.

5.2 Content and Classifications

The Chief CTOC has the responsibility for maintaining the TRM and its relationship to the SRM. In evaluating the usability and desirability of technology items, it will be necessary to form teams (TETs) for a limited time and a specific purpose to study that technology and make a recommendation for its description in the TRM. The TETs are not standing bodies, and so do not represent a continued or unpredictable drain on Bureau or DOI resources. Recommendations from the TETs will be approved by the CTOC before entry into the TRM.

5.3 Waivers

The CTOC is also involved in the analysis of waivers for technology users whose needs are not appropriately met by the technology items in the TRM. This may be the case due to the necessity to replace Limited Use equipment and stay within the same product family for maintainability or cost reasons. Also, in cases where the mission needs do not reflect those shared by the majority of the DOI users of that technology, a waiver is viewed as the means to avoid having to specify technology used in small quantities[13].

The waiver process begins when a Bureau or Office CIO makes a request to the DOI CIO for a technology waiver. The background, justification, conditions, and procedures for administering the waiver are presented in the request, and are reviewed by the DOI CIO for suitability and alignment with DOI business and IT investment priorities. If the request meets these criteria, the request is referred to the CTO Council for technical evaluation. The CTOC may refer the matter to a standing body such as the Information Technology Security Team (ITST) or the Department Web Council (DWC) if their input is needed. If there is no standing body and the waiver subject requires study before it can be decided, the CTOC can form a TET for the purpose of evaluating the waiver subject. A vote of the CTOC on the waiver will be taken to recommend its acceptance or rejection and any additional conditions deemed advisable, and this recommendation will be presented to the DOI CIO. The DOI CIO will then decide to accept or reject the waiver request, and the result will be published on the TRM Portal intranet site. Templates for

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[13] The measurement used to determine whether a particular service or application of technology should be represented in the IEA model structure is the 80% rule. If fewer than 20% of DOI users of similar technology have a mission need which requires a particular solution, that solution is managed by waiver, so that the adherence to the TRM can be maintained and deviations from it can be monitored.

the request, recommendation, and decision memoranda will be available on the TRM Portal intranet site as well.

5.4 TRM and Project Relationships

In the genesis and maturation of IT projects at DOI, the various governance bodies have distinct roles to play in developing, approving, guiding, and supporting the project plans and products. While the process of aligning IT governance with project management is ongoing, a preliminary view is presented here. Figure 16 through Figure 17 show how the CTOC is involved in the project at key points to estimate, evaluate, and populate the technology items which are needed to accomplish the project mission within DOI standards and guidelines, and to maximize the degree of infrastructure re-use and interoperability obtained by the final product. Solution Architecture is invoked early, once the performance and business factors have been established, to ensure that the architectural vision is aligned with mission needs and objectives. Once the Technology Assessment has been structured and performed, the Solution Architecture of the project

can be updated and extended to flesh out the design pattern needed for service delivery.
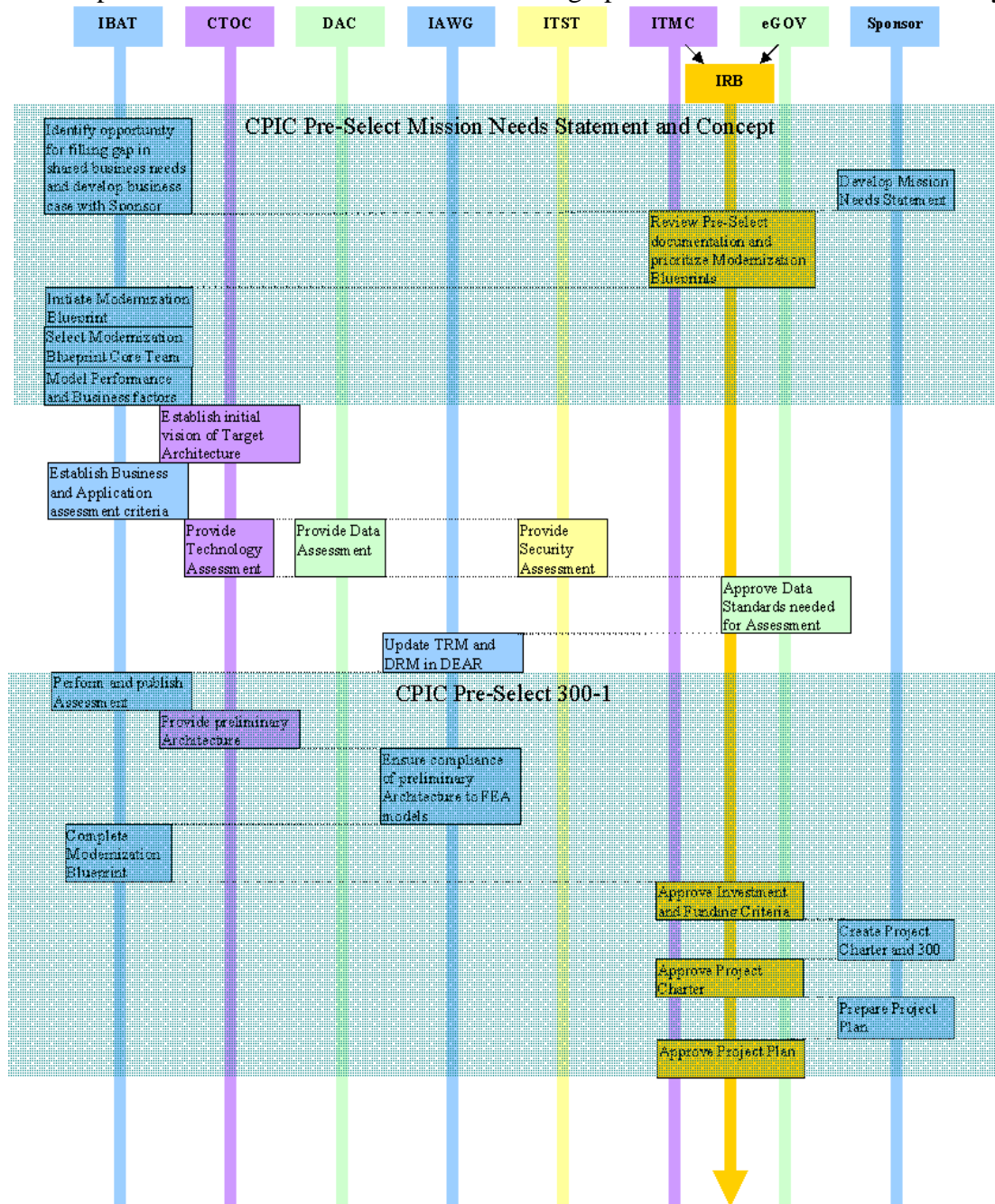
Figure 16. TRM Use in Single-Project Realization

Connection to services already offered and infrastructure elements in place that satisfy the non-functional requirements[14] of the project are analyzed to determine where economies can be made without compromising the mission or the security of the system.
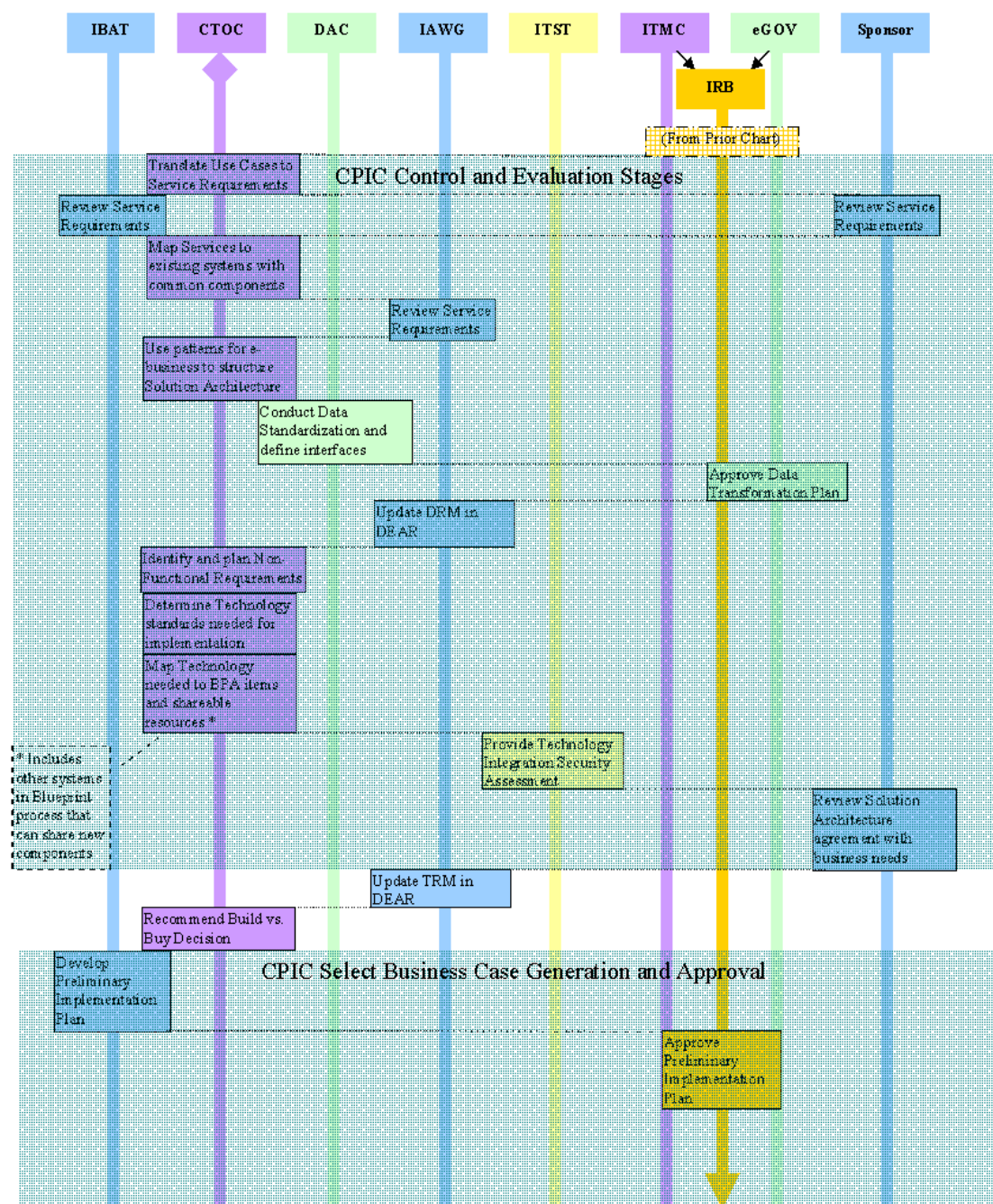
Figure 17. TRM Use in Project Realization (cont'd)

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[14] Non-functional requirements are those necessities for continued system operation that do not derive from factors specific to this mission. Backup and recovery, network element management, and security monitoring are several areas where facilities in place may satisfy non-functional requirements.
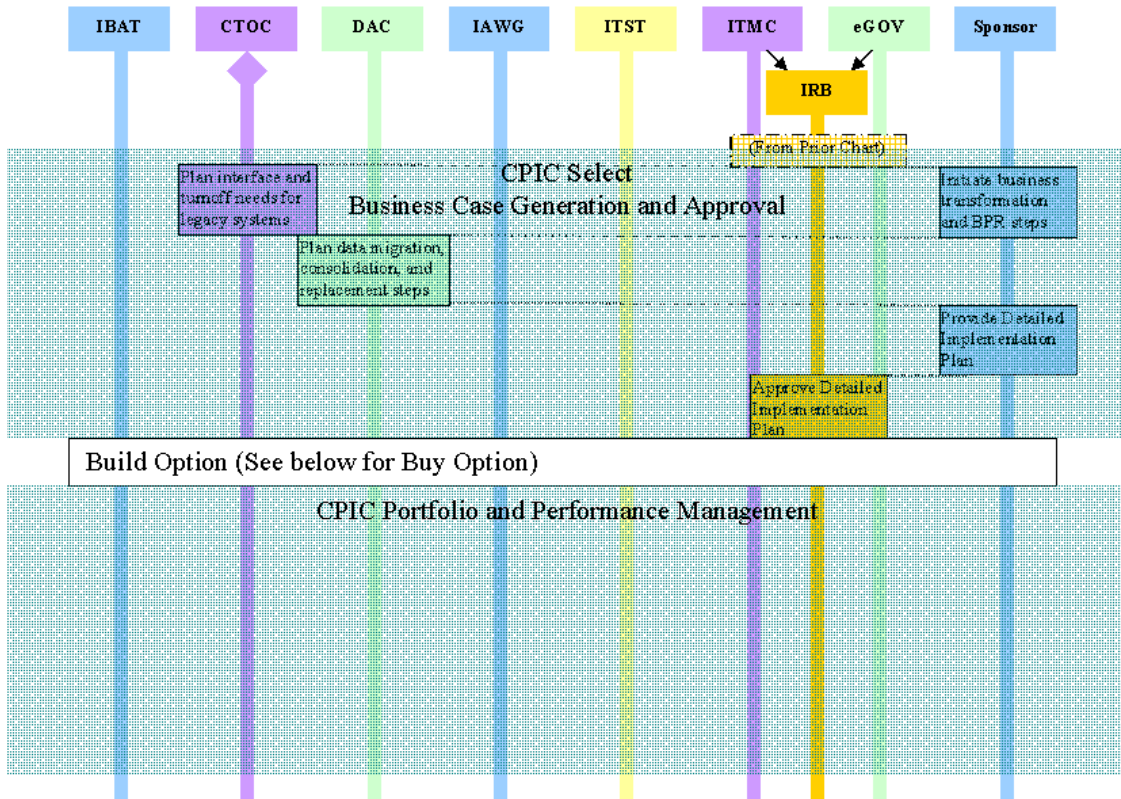
Figure 18. TRM Use in Project Realization (cont'd)

Another key aspect of TRM involvement in the Solution Architecture process is to identify items subject to enterprise-wide buys through mechanisms such as Enterprise License Agreements (ELAs) or Blanket Purchase Agreements (BPAs) to decrease their component cost, and factor these items into the project technology plan. The key to identifying the select technologies is to determine whether they comply with the most up-to-date technology standards, and whether they are widely used by various DOI bureaus and offices to support major IT investments. Once the decisions are made to proceed with enterprise-wide buys for the select items, all of the acquisition processes need to be coordinated through DOI's Enterprise Resource Management office.

Key elements of the resulting plan may be determined to be part of the DOI Technology Core, and therefore may indicate that the system should be built in-house as opposed to contracted out. The replacement of existing technology items in the TRM and connection to existing services is then planned, so that availability of crucial services is preserved until newly implemented capabilities are tested and ready to replace them.

6   Tmart User's Guide

The Tmart is a tailored presentation of the technology items in the TRM, intended to allow a wide variety of query and reporting alternatives to maximize the value of the TRM content to the DOI user community. It will continue to change in response to the needs of DOI, both in terms of maturity of IEA technology tracking and in terms of discovery of additional uses and methods of application of the TRM information. A separate online version of the Tmart User's Guide will be available for reference, and will be updated to reflect these added or changed capabilities. When major releases of the TRM are issued, the Tmart User's Guide will be updated in the documentation as part of that release.

6.1   General Description

The Tmart is currently available as a Microsoft Access database with online extensions. As described in Section 4.1.2, the data is initially extracted from the DEAR repository and is cleaned to assure that duplications and similar inconsistencies aren't introduced. The data is then combined with any existing non-DEAR technology items and with information from procurement. A set of forms and reports allows different communities of interest to view and query the Tmart information as best befits their needs.

6.1.1 Specification Display Form

The Tmart has one major form, which is displayed when the file is opened. This form displays the Technical Service Specifications from the TRM in a grid, with drop-down boxes available to limit the display based upon contents of the various TRM fields. Figure 19 shows this main form with no constraints placed on the data display; Figure 20 shows the form with the Specification Type constrained to "Specification" and the Classification of the Technical Service Specification constrained to "Limited Use".

Figure 19. Tmart Main Form, Unconstrained

This allows Tmart users to select specific areas of the TRM for viewing. If the user wishes to preserve the information shown, it can be printed as a report using the Print List button (see Figure 21). Access also allows grid contents to be selected and pasted into Excel spreadsheets or Word documents. The sort order of displayed technology items can be modified by clicking the Sort Order button and selecting the desired fields on the Sort Order Selection Form (Figure 22). Help for these and other functions can be viewed by Clicking the Help Button and choosing a topic on the Help Form (Figure 23).

Figure 20. Tmart Main Form, Type and Classification Constraints

Figure 21. Printed Technology List Report

Figure 22. Sort Order Selection Form

Figure 23. Tmart Help Form

6.2 New System Implementation

To avoid paralysis, the design and implementation of new systems needs to occur in parallel with the management of existing technology and systems. The application of Solution Architecture to new systems provides a tested, structured approach to this process to achieve maximum alignment with the IEA. The technology standards, specifications, and products will be available to tools for Solution Architecture requirements management and solution definition.

Solution Architecture takes the mission of each system, identifies the business goals through use cases, and then defines services that provide the functionality needed to accomplish those business goals. The constituent services are then instantiated through the use of architectural patterns as illustrated in Figure 24. Each block of the architectural pattern corresponds to a Technical Service Specification from the TRM, and has substandards and specifications that can be used to determine the range of products that can be used to construct the ultimate implementation. If the decision is to buy a solution rather than to build it, these standards and specifications can be used to validate proposed solutions.

Since Solution Architecture is a cradle-to-grave approach to system implementation, tool sets have been developed to facilitate the early stages described above, as well as project management and portfolio management aspects of implementation and operation. As more projects within DOI are implemented through Solution Architecture, the interrelation of the requirements embodied by service descriptions and technology standards will allow more sophisticated analysis and management, leading to more accurate estimation of costs and schedules associated with technology upgrades.
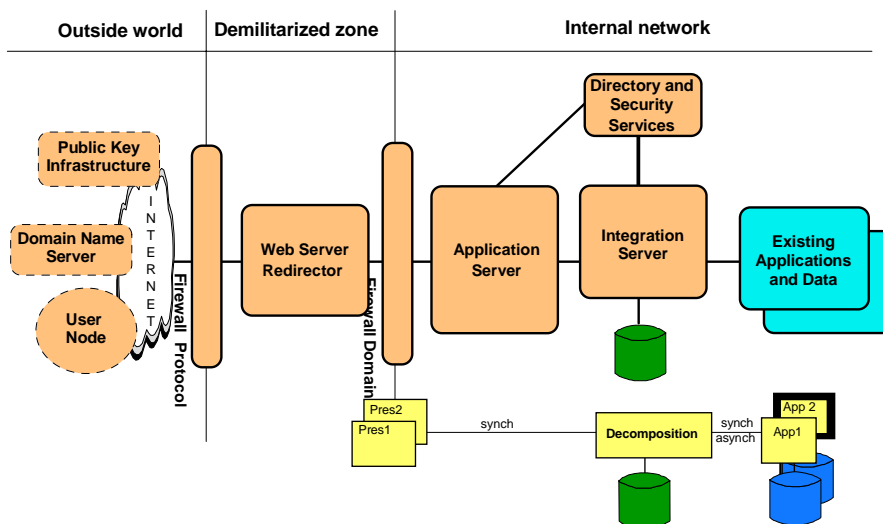

Figure 24. Solution Architecture Patterns

The Rational tool set has been used to define the Solution Architecture of the Incident Management, Analysis, and Reporting System (IMARS), and will be populated with the standards and specifications, and products from the TRM to support Solution Architecture use in IMARS and future projects. The Solution Architecture can make use

of the TRM before integration with the chosen tool set is complete through reports that detail the standards and specifications to be observed in the architecture, and that detail the platform-specific products that meet DOI requirements within the different supporting platforms available for the solution.

6.3 Existing System Evaluation

The information on technology currently in use throughout DOI must be used to determine where products used in several locations can be combined or purchased in bulk to achieve added cost-saving. Negotiation of ELAs for select desktop software and database systems has been successful in significantly decreasing the cost of these technology items in comparison with some GSA-schedule costs for the same or similar product packages. In order to support this activity, it is necessary to gather a significant amount of acquisition-related information as part of this TRM update effort so that priority can be assigned to the technology items, particularly those identified under the "Preferred" category that may be good candidates for future enterprise-wide buys. Specifically, this information will be used to determine: 1) whether any of the contracts that currently exist at the bureau-level for the "Preferred" products are open to other DOI bureaus and offices to use; and 2) in conjunction with acquisition, whether any of the contracts that are about to expire and are currently restricted to bureau use can be used agency-wide when re-competed. Based upon this information, reports will be generated to identify and rank technology use so that ERM will be able to select suitable targets for future enterprise-wide buys. The current list of products in the TRM accompanies this document.

6.4 Technology Transition and Retirement

The aspects of portfolio management that allow advanced planning and project synchronization are supported by information on which technology items will need to be upgraded or replaced, and what schedule leeway is available concerning their replacement. Budgeting for technology replacement is becoming exceedingly complex as the effort to manage cross-Bureau technology gains momentum. The current TRM contains basic information on version acceptability and obsolescence, and this can be used for the assignment of basic priorities at the Bureau level.

Reports are available from the Tmart to identify technology items classified as Limited Use and Obsolete so that they can be targeted for efficient removal and replacement with items approved for DOI use. In light of the need to identify critical failings in technology items that are already in use, the new classification of Replacement has been added to flag items where continued use poses a serious risk either in mission accomplishment or in security. Additional information is needed at the detail level to allow release management and operations planning, but that information can be added once the technology update for Version 3 has been completed. The addition of known information on software version availability and lifetime can be used to generate sequencing reports for effective control of version introduction in the operational environment.

6.5 Technology Procurement

In order to make the TRM useful for the general procurement of technology, it is important that the acquisition arms of DOI and its Bureaus have appropriate access to the information it contains. These groups must also have sufficient input into the process of technology purchase so that they can ensure that the appropriate acquisition strategy was implemented in compliance with the Federal Acquisition Regulations (FAR) and OMB mandates regarding brand-specific purchases to obtain the desired IT products and services on an enterprise-wide basis. ELAs and BPAs should be established in concert with the processes referenced in an ERM acquisition policy document entitled, ***DOI GUIDANCE FOR ESTABLISHING ENTERPRISE-WIDE AGREEMENTS,*** dated November 2004, which can be accessed off the ERM home page link - http://www.doi.gov/ocio/erm/policies.html.

The acquisition strategy outlined in Figure 1 outlines a competitive process where vendor are asked to respond to a formal solicitation document that outlines the desired product functionality. In turn, the vendor offerings are evaluated against the established evaluation criteria provided in the solicitation document, and ranked accordingly. Ultimately, the product that is selected, is deemed to fully meet the defined technical requirements at the most competitive price. Although the processes outlined in the Figure below are aimed at educating the DOI customers as to what needs to occur to establish enterprise-wide agreements, ultimately it is up to DOI's contracting specialists to identify the most appropriate acquisition strategy on a case-by-case basis.

Figure 25 - Acquisition Process Used to Establish Enterprise-wide Agreements for IT Products & Services
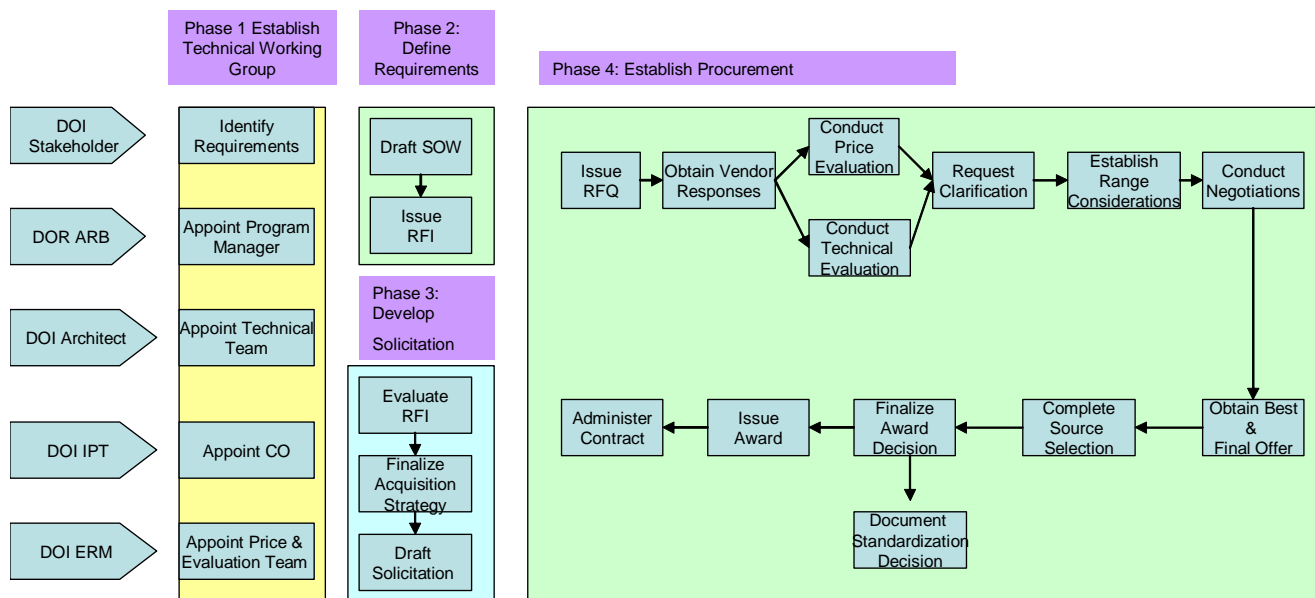

Figure 1 outlines the four sequential phases of the acquisition process that ultimately lead to the establishment of DOI-wide agreements in concert with the TRM requirements. Once these agreements are in place, they reflect standardization decisions on select

products, and serve as mandatory contract vehicles for use by all DOI bureaus and offices in supporting their respective IT projects. In turn, the DOI TRM is updated on an on-going basis to reflect the products acquired as "Licensed by DOI".

Reports are available from the Tmart to show technology with classifications of "Licensed by DOI" and "Preferred", listed by the Technology Standard to which they adhere. These reports may be used by technology purchasers to identify candidate technology for specific uses, and to resolve initial design decisions concerning interconnection and functionality mapping within their existing and emerging systems. When a request for such a purchase is submitted, Acquisition representatives will be able to verify that the requested technology product or service is in the TRM, and that its classification assumes compliance with DOI's established technical standards and guidelines.

If the product or service offering has already been evaluated by procurement or is classified as "Licensed by DOI", it has been deemed appropriate from both technical and acquisition standpoints for enterprise-wide use. Assuming that the contracts for products classified under this category are still current, they are available to all DOI bureaus and organizations for use.

If the product is classified as "Preferred" in the TRM, it is assumed to comply with DOI's established technical standards and widely used by select DOI bureaus. The requested acquisition information will be used to confirm whether these products are widely used by various DOI bureaus and offices. Some of the items identified under this category may be candidates for future enterprise-wide buys, based on the recommendations provided by the CTO Council. If the decision is made to pursue their acquisition on an enterprise-wide basis, the ultimate result would be to change the item classification from "Preferred" to "Licensed by DOI", as long as all relevant regulations (acquisition and others) so permit.

Ultimately, the established linkages between the CTO Council and the ERM Program will help ensure that the technologies that best support DOI's major enterprise investments, as reflected in the TRM, are acquired in the most cost-efficient and timely manner.

Appendix A. Document References

The following documents provide supporting information for the TRM Guidance Document, and should be considered part of the information necessary to give context and history to the presentation herein. They are referenced by hyperlinks through the text where they are pertinent, but are gathered here for general reference. For the purpose of major releases, these documents will be provided along with the TRM Guidance Document so that all users of the document will have local access to them for reference purposes.

Homeland Security Act of 2002

National Intelligence Reform Act of 2004

President's Management Agenda

Federal Enterprise Architecture (FEA)

Interior Enterprise Architecture (IEA)

Interior Solution Architecture

IEA Architectural Principles

IEA Governance Bodies

Interior Acronym List

Interior Glossary